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⑩ A wood preservative composition, process for treating wood with the same, and wood treated with the same.

⑩ A wood preservative composition including a preservative component which is selected from the group consisting of copper borate and zinc borate, a volatile basic compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water, a process for preserving wood with the wood preservative composition, and a wood preserved with the wood preservative composition. The wood can be protected from wood attacking organisms for a prolonged period of time without involving environmental pollutions.



DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 5)
X	CA-A-1 058 353 (J. KRZYZEWSKI) * Page 7, lines 1-15; page 8, lines 13-16, 24-25, 30-31; page 10, line 27 - page 10a, line 15; page 24, lines 6-12; page 27, example 9; page 28, examples 11,12; page 33, examples 15,16; claims *	1-4,11	B 27 K 3/52 B 27 K 3/22 B 27 K 3/32
X	---	1,11	
X	CHEMICAL ABSTRACTS, vol. 88, no. 20, 15th May 1978, page 84, abstract no. 138127v, Columbus, Ohio, US; B.R. JOHNSON et al.: "Ammoniacal copper borate: a new treatment for wood preservation", & FOR. PROD. J. 1978, 28(2), 33-6		
X	---	1	
A	---	5-7	
A	---	1,8-10	TECHNICAL FIELDS SEARCHED (Int. Cl. 5)
A	EP-A-0 320 786 (Dr. WOLMAN GmbH) * Page 6, lines 1-8 *		
A	---		B 27 K
A	GB-A-2 082 912 (BROR OLOF HÄGER) ---		
A	W. KLEEGEL: "BOR in Biologie, Medizin und Pharmazie", 1980, pages 172-178, paragraph 3.4.4.5, Springer-Verlag, Berlin, DE; "Antifungale Anwendungen im Holzschutz" * Page 175 *	1-20	

The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	20-08-1991	DALKAFOUKI A.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

BACKGROUND OF THE INVENTION AND RELATED ART STATEMENT

SL

This invention relates to a wood preservative composition, process for treating wood with a wood preservative composition, and wood treated with a wood preservative composition.

As durable wood preservative composition, conventionally, a water solution containing a metal compound and/or an inorganic compound has been used in a wide range for a long time. Such a solution is impregnated into wood to produce wood capable of keeping wood attacking organisms from growing therein.

For example, the following compounds have been mainly used as preservative ingredients for wood preservative composition: Copper compounds such as copper acetate, copper chromate; Chrome compounds such as potassium chromate, sodium dichromate; Mercury compounds such as mercury chloride; Arsenic compounds such as arsenious acid; Fluorine compounds such as sodium fluoride; and Boron compounds such as boric acid and borax. These compounds are mixed in a proper proportion and dissolved in water to produce a wood preservative solution.

In some cases, also, a fixing agent such as acetic acid or aqueous ammonium is added into the solution. When the solution containing such a fixing agent is impregnated into wood, chemical reactions between preservative ingredients, between a preservative ingredient and the fixing agent, and between a preservative ingredient and the wood take place, so that the preservative ingredient is fixed on the wood to ensure the wood preservative effect for a long period of time.

Especially, a combination of copper compound, chrome compound, and arsenic compound has been widely used as active preservative ingredients for a wood preservative composition. A solution containing these compounds has been called CCA preservative composition. Also, a combination of copper compound, chrome compound, and boric acid has been used as active preservative ingredients for a wood preservative composition. A solution containing these compounds has been called CCB preservative composition.

The CCA preservative composition and CCB preservative composition are comparatively cheap and have a long-time effectiveness. However, the arsenic compound is poisonous. Also, heavy metal compounds such as chrome and mercury have considerably high toxicity to warm-blooded animals.

Accordingly, severe attention has been necessary to pay to workers' health at the time of preparing such a preservative composition and treating wood with the preservative composition.

Also, in discarding unnecessary pieces of wood treated with such a preservative composition which inevitably are produced as by-product when the wood is cut into a desired form, furniture made of wood treated with such a preservative composition, or building materials of wood treated with such a preservative composition, severe management have been required to prevent environmental pollution. Further, even if such scraps are burnt, toxic substances diffuse in the air or remain in 1shes for a long time and cause environmental problems.

Moreover, in addition to the problem of having high toxicity to warm-blooded animals, the CCB preservative composition has a problem that the boric acid is liable to be leached, which results in reduction of the preservative effectiveness.

To avoid the environmental pollution, use of organic metal compounds such as copper naphthenate, zinc naphthenate, or quaternary ammonium compounds has been proposed. However, these preservative ingredients have shorter-term effectiveness. Particularly, it has been impossible to employ these preservative ingredients for wood for building base.

In view of the above-mentioned problems, a wood preservative composition has been desired which makes it possible to protect wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions. Also, eagerly have been desired a process for treating wood with a preservative composition capable of protecting wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions, and wood treated with a preservative composition capable of protecting wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions.

Accordingly, it is a first object of the present invention to provide a wood preservative composition which makes it possible to protect wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions.

Also, it is a second object of the present invention to provide a process for treating wood with a wood preservative composition capable of protecting wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions.

Further, it is a third object of the present invention to provide wood treated with a wood preservative composition capable of protecting wood from wood attacking organisms for a prolonged period of time without involving environmental pollutions.

SUMMARY OF THE INVENTION

According to the present invention, a wood preservative composition comprises a preservative component which is selected from the group consisting of copper borate and zinc borate, a volatile basic compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water.

According to the present invention, also, a process for preserving wood comprises the steps of impregnating the wood with a wood preservative composition including a preservative component which is selected from the group consisting of copper borate and zinc borate, a volatile basic compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water, and drying the impregnated wood to remove the volatile basic compound and water.

According to the present invention, further, a wood is produced by impregnating the wood with a wood preservative composition including a preservative component which is selected from the group consisting of copper borate and zinc borate, a volatile basic compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water, and drying the impregnated wood to remove the volatile basic compound and water.

The wood preservative composition of the present invention, which does not contain poisonous substances such as chrome compound, arsenic compound as the CCA preservative composition, have necessary anti-insect and anti-fungi effectiveness for a prolonged period of time without involving the environmental pollution

Also, the wood preservative composition of the present invention, which does not contain chrome compound and free boric acid as the CCB preservative composition, have no toxicity to warm-blooded animals, and is unliable to be leached. Accordingly, the wood preservative composition can have necessary anti-insect and anti-fungi effectiveness for a prolonged period of time.

Further, wood treated with the wood preservative composition of the present invention makes it possible to assure long use as safe wood materials for building, furniture, and the like.

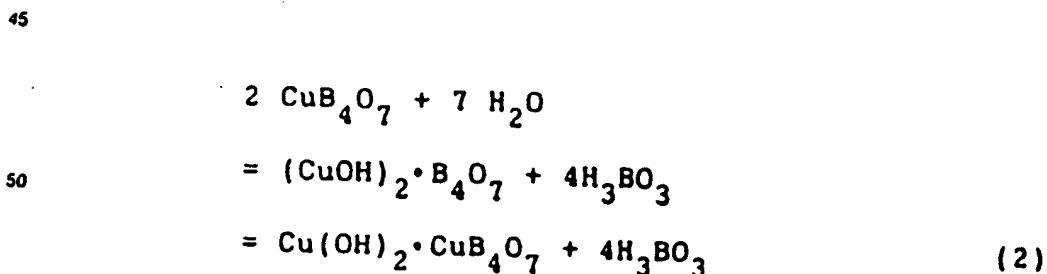
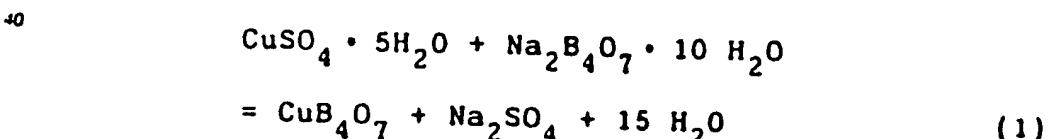
These and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description.

DETAILED DESCRIPTION OF THE INVENTION

In the present invention, the following starting materials will be used.

1. COPPER TETRABORATE MONOBASIC-- $Cu(OH)_2 \cdot CuB_4O_7 \cdot 10 H_2O$...

Copper Tetraborate.monobasic is prepared by a reaction of copper sulphate with borax. The reaction is seen to occur as shown in the following reaction formulas. Specifically, copper tetraborate is firstly produced as shown in FORMULA (1). The produced copper tetraborate is washed with water repeatedly to produce copper tetraborate.monobasic as shown in FORMULA (2).



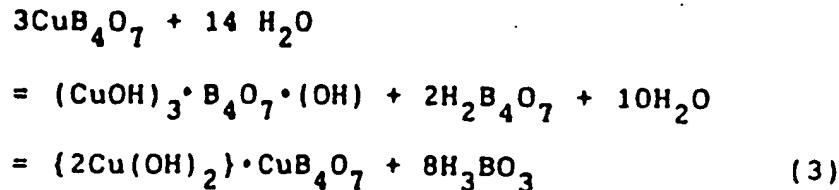
As an example, 381.5 parts by weight (hereinafter called "parts") of water solution containing 2 percent decahydrated borax $Na_2B_4O_7 \cdot 10H_2O$ were added, under stirring, to 50 parts of water solution containing 10 percent pentahydrated copper sulphate $CuSO_4 \cdot 5H_2O$ at room temperature, resulting in blue precipitation. The precipitation was filtered and washed with water repeatedly until unreacted borax was completely

removed, and dried at 40 °C for 24 - 48 hours. Consequently, 2.69 grams of copper tetraborate,monobasic were obtained.

2. COPPER TETRABORATE DIBASIC-- $2\text{Cu}(\text{OH})_2 \cdot \text{CuB}_4\text{O}_7$ --

5 Copper Tetraborate,dibasic is prepared by mixing a solution containing a high concentration of copper sulphate and a solution containing a high concentration of borax at a remarkably high temperature, e.g., 50 °C. Specifically, immediately after copper tetraborate is produced as shown in FORMULA (1), as shown in FORMULA (3), a hydrolysis occurs to produce copper tetraborate,dibasic.

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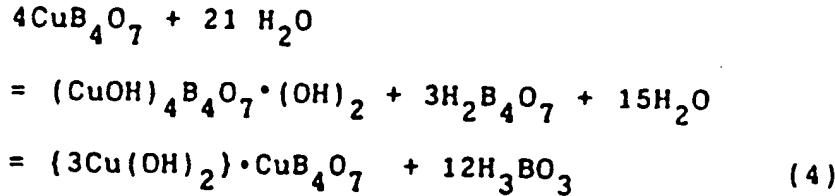


20 For example, 763 parts of water solution containing 10 percent decahydrated borax $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$ were added, under stirring, to 125 parts of water solution containing 40 percent pentahydrated copper sulphate $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ at 50 °C. The solution was kept at 50 °C for 1 hour, and then kept at 20 - 30 °C for one night, consequently resulting in a precipitation. The precipitation was filtered and washed with water repeatedly until unreacted borax was completely removed, and dried at 40 °C. Consequently, 26.81 grams 25 of copper tetraborate,dibasic were obtained.

3. COPPER TETRABORATE TRIBASIC-- $3\text{Cu}(\text{OH})_2 \cdot \text{CuB}_4\text{O}_7$ --

30 Copper tetraborate,tribasic is prepared by mixing a solution containing a high concentration of copper sulphate and a solution containing a high concentration of borax at a remarkably high temperature, e.g., 60 °C with adding a greater amount of water with maintaining a ratio of one mole copper sulphate to one mole borax. Specifically, after copper tetraborate is produced as shown in FORMULA (1), water washing is executed repeatedly to produce copper tetraborate,tribasic as shown in FORMULA (4).

35



40 For example, 12.5 parts of water solution containing 40 percent pentahydrated copper sulphate $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and 75 parts of water solution containing 10.2 percent decahydrated borax $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$ were mixed with maintaining the ratio of 1 to 6, i.e., the ratio of one mole to one mole, at 60 °C. 100 parts of water were added into the solution at 60 °C, and was kept at 60 °C for 1 hour, and then kept at 20 - 30 °C for one night, consequently resulting in a precipitation. The precipitate was filtered and washed with water repeatedly until unreacted borax was completely removed, and dried at 60 °C for 48 hours. Consequently, 45 2.43 grams of copper tetraborate,tribasic were obtained.

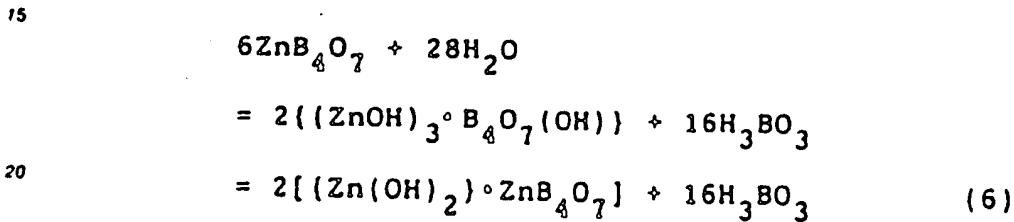
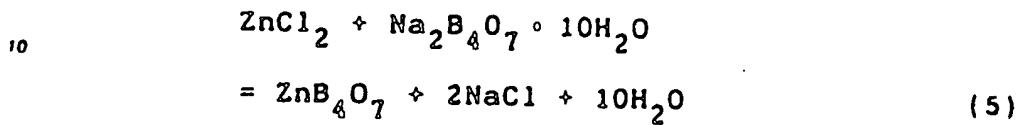
45 It has been known that copper or copper compounds are toxic to wood attacking fungi, and boric acid is toxic to wood attacking insects, such as termite. Accordingly, it will be seen that the above-mentioned three copper borate are toxic to both wood attacking fungi and wood attacking insects because of having copper component and boric acid component.

50 Also, the above-mentioned three copper borates are insoluble in water. In particular, it is unlikely that the three copper borates decompose to release boric acid even when the above-mentioned three copper borates are dissolved in water. Accordingly, the three copper borates are rarely leached, and thus can maintain the wood preservative effect for a prolonged period of time.

monobasic
of copper
e. e.g., 50
is shown in

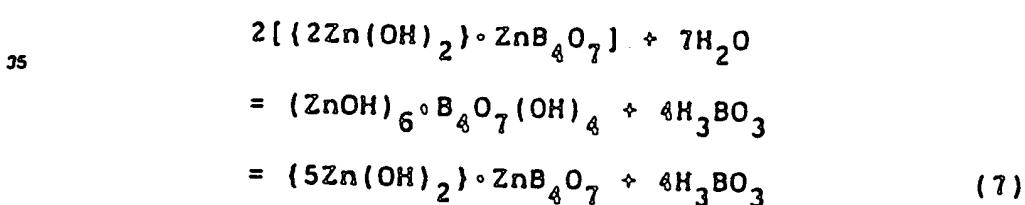
4. ZINC TETRABORATE DIBASIC-- $2\text{Zn}(\text{OH})_2 \cdot \text{ZnB}_4\text{O}_7 \cdot \text{H}_2\text{O}$

Zinc tetraborate,dibasic is prepared by a reaction of zinc chloride with borax. The reaction is seen to occur as shown in the following reaction formulas. Specifically, zinc tetraborate is firstly produced as shown in FORMULA (5). The produced copper tetraborate is immediately hydrolysed to produce zinc tetraborate,dibasic as shown in FORMULA (6).



As an example, 381.5 parts of water solution containing 2 percent dehydrated borax $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ were added, under stirring, to 27.3 parts of water solution containing 10 percent zinc chloride ZnCl_2 at the room temperature, resulting in a white-colored precipitation. The precipitation was filtered and washed with water repeatedly until unreacted borax was completely removed, and dried at 40 °C for 24 hours or more until the reduction of weight of the precipitation diminishes. Consequently, 2.90 grams of zinc tetraborate,dibasic were obtained.

When dissolved in water in the presence of a volatile basic compound, zinc tetraborate,dibasic decomposes to produce zinc tetraborate,pentabasic as shown in FORMULA (7).

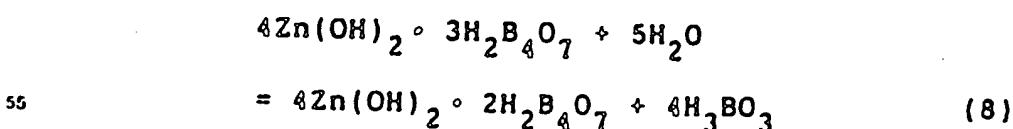


The above-mentioned zinc tetraborate dibasics are called Zinc tetraborate,tribasic, monohydroxide and represented by $(\text{ZnOH})_3 \cdot \text{B}_4\text{O}_7(\text{OH})$.

5. TETRA ZINCHYDROXIDE TRI(TETRABORIC ACID) SALT-- $4\text{Zn}(\text{OH})_2 \cdot 3\text{H}_2\text{B}_4\text{O}_7 \cdot \text{H}_2\text{O}$

This compound is produced and sold by Tomita Seiyaku Kabushiki Kaisha, a Japanese chemical company, under a brand name of "ZINC BORATE 2335", and thus easily available.

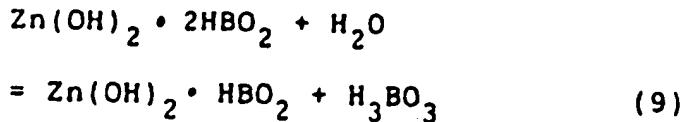
This zinc borate is dissolved in water in the presence of a volatile basic compound to produce tetra zinchydroxide di(tetraboric acid) salt as shown in FORMULA (8).



6 ZINC HYDROXIDE DIMETABORIC ACID SALT -- $\text{Zn(OH)}_2 \cdot (2\text{HBO}_2)$ or $\text{ZnO} \cdot \text{B}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ --

This compound is produced and sold by Tomita Seiyaku Kabushiki Kaisha under a brand name of "Zinc Borate 101", and thus easily available.

5 When this zinc borate is dissolved in water in the presence of a volatile basic compound, a hydrolysis occurs to produce zinchydroxide,monometaboric acid salt as shown in FORMULA (9).



15 As mentioned earlier, boric acid is toxic to wood attacking insects. Also, zinc or zinc compounds are toxic to wood attacking fungi. Accordingly, it will be seen that the above-mentioned zinc borates are toxic to both wood attacking fungi and wood attacking insects.

19 Also, when zinc tetraborate,dibasic, tetra zinchydroxide tri(tetraboric acid) salt, and zinc hydroxide,dimetaboric acid salt are dissolved in water in the presence of a volatile basic compound:

the zinc tetraborate,dibasic causes zinc tetraborate,pentabasic;

20 the tetra zinchydroxide,tri(tetraboric acid) salt causes tetra zinchydroxide di(tetraboric acid) salt; and the zinchydroxide,dimetaboric acid salt causes zinc hydroxide,monometaboric acid salt.

25 In these reactions, a negligably small quantity of boric acid is released, and then leached. However, an almost quantity of boric acid remains, and is thus unlikely to be leached. Accordingly, the preservative effectiveness is maintained for a prolonged time.

29 A reason why an almost quantity of boric acid is not leached when employing both copper borate and zinc borate could be explained as follows. Copper borate and zinc borate impregnated into wood may have the following hydrolysis balances:



35 In one of the above opposite reactions, boric acid is produced. Accordingly, the concentration of boric acid progressively increases and exceeds a threshold concentration, which consequently causes the opposite reaction and prevents the hydrolysis.

40 In the case of dissolving only copper borate in water to prepare a wood preservative composition, appropriate parts of copper borate may be replaced with other inexpensive copper compound to reduce the preparation costs. As inexpensive copper compounds can be cited copper acetate, copper hydroxide, or chloride. Also, copper borate has slightly lower toxicity than zinc borate against wood attacking insects. Accordingly, an appropriate amount of zinc borate may be added into a wood preservative composition containing copper borate to increase the insect toxicity of the wood preservative composition.

45 In the case of dissolving only zinc borate in water to prepare a wood preservative composition, appropriate parts of zinc borate may be replaced with other inexpensive zinc compound to reduce the preparation costs. As inexpensive zinc compounds can be cited zinc acetate, zinc hydroxide, or zinc chloride. Also, zinc borate has slightly lower toxicity than copper borate against wood attacking fungi. Accordingly, an appropriate amount of copper borate may be added into a wood preservative composition containing zinc borate to increase the fungus toxicity of the wood preservative composition.

50 Also, it will be seen that copper borate and zinc borate are dissolved in water in an appropriate proportion to produce an optimum preservative composition which has both high insect toxicity and high fungus toxicity for a prolonged period of time.

55 In the present invention, the following volatile basic compounds may be used: the primary, secondary and tertiary aminos having a boiling point of 100 or less Centigrado degrees, such as ammonia (in the form of aqueous ammonia), monomethylamino, dimethylamino, trimethylamino, monopropylamino, dipropylamino, tripropylamine, and monopentylamine and the like.

Also, it is preferable to add ammonium compounds, such as ammonium chloride, ammonium carbonate, as dissolving agent to increase the dissolving ratio of copper borate and zinc borate, and assure a stabilized solution.

Further, it is preferable to add the following penetrating agents: aliphatic dihydric alcohol such as

ethylene glycol, propylene glycol, and water soluble alkyl ether of the aliphatic dihydric alcohol and water soluble alkyl ester of the aliphatic dihydric alcohol, other known various kinds of surfactant.

Furthermore, it is preferable to add aromatic agents such as perfume, and coloring agents such as dyestuff.

- 5 In preparation of a wood preservative composition using only copper borate as preservative ingredient, 0.1-5 parts of copper borate are added with respect to 100 parts of the wood preservative composition. The more quantity of copper borate is added, the higher the anti-insect and anti-fungi effect is because of more quantity of copper borate is fixed on wood. However, in the case of more than 5 parts, copper borate is difficult to dissolve in the composition. Also, wood is highly colored. In the case of less than 0.1 parts, a desired anti-insect and anti-fungi effect cannot be obtained. Furthermore, it is preferable to use 0.5-2 parts of copper borate with respect to 100 parts of the wood preservative composition.
- 10

When adding a volatile basic compound, 80-160 parts of volatile basic compound is added with respect to 100 parts of copper borate. In the case of less than 80 parts, the solubility of copper borate is insufficient. In the case of more than 160 parts, a stronger odor occurs. It is preferable to use 80-100 parts of volatile basic compound with respect to 100 parts of copper borate.

When adding an auxiliary dissolving agent such as ammonium chloride, a preferable proportion is 10-30 parts of auxiliary dissolving agent to 100 parts of copper borate.

In preparation of a wood preservative composition using only zinc borate as preservative ingredient, 0.1-10 parts of zinc borate are added with respect to 100 parts of the wood preservative composition. The more

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quantity of zinc borate is added, the higher the anti-insect and anti-fungi effect is because of more quantity of zinc borate is fixed on wood. However, in the case of more than 10 parts, zinc borate is difficult to dissolve in the composition. In the case of less than 0.1 parts, a desired anti-insect and anti-fungi effect cannot be obtained. It is further preferable to use 0.5-2 parts of zinc borate with respect to 100 parts of the wood preservative composition.

When adding a volatile basic compound, 75-160 parts of volatile basic compound are added with respect to 100 parts of zinc borate. In the case of less than 75 parts, the solubility of zinc borate is insufficient. In the case of more than 160 parts, a stronger odor occurs. It is preferable to use 75-100 parts of volatile basic compound with respect to 100 parts of zinc borate.

When adding an auxiliary dissolving agent such as ammonium chloride, a preferable proportion is 10-100 parts of auxiliary dissolving agent to 100 parts of zinc borate.

In preparation of a wood preservative composition using both copper borate and zinc borate as preservative ingredient, 0.1-10 parts of mixture of copper borate and zinc borate are added with respect to 100 parts of the wood preservative composition. Also, volatile basic compound and auxiliary dissolving agent are preferably added. The proportions of volatile basic compound and auxiliary dissolving agent may

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be determined in accordance with the respective quantities of copper borate and zinc borate.

Further, appropriate quantities of penetrating agent, aromatic agent, and coloring agent may be added depending on occasion.

Steps of preparing wood preservative compositions of the present invention are as follows.

In preparation of a wood preservative composition containing copper borate as preservative ingredient,

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- 45
- 50

firstly, an aqueous ammonia or another volatile basic compound is dissolved in water to prepare a water solution. Secondly, a proper quantity of copper borate is added in the water solution at room temperature, and then stirred to completely dissolve it in the water solution. If required, in addition to copper borate, appropriate quantities of other copper compound, zinc compound, and additives are added and stirred in the water solution.

As another preparation, a first water solution which contains copper borate, and a second water solution which contains other copper compound, zinc compound, and additives are separately prepared. Thereafter, the first water solution and the second water solution are mixed to prepare a wood preservative composition containing copper borate as preservative ingredient.

In preparation of a wood preservative composition containing zinc borate as wood preservative

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- 55

ingredient, firstly, zinc borate and a small quantity of water are mixed at room temperature to prepare a paste or slurry. Secondly, an appropriate quantity of aqueous ammonia or other volatile basic compound is added to the paste or slurry, and stirred to prepare a solution. Finally, a necessary quantity of water is added to the solution to prepare the wood preservative composition containing a desired concentration of zinc borate. Also, if required, in the first step, appropriate quantities of other zinc compound, copper compound, and additives are added in addition to zinc borate to prepare a mixture in the form of paste or slurry.

As another preparation, a first water solution which contains zinc borate, and a second water solution which contains other zinc compound, copper compound, and additives are separately prepared. Thereafter,

the first water solution and the second water solution are mixed to prepare a wood preservative composition containing zinc borate as preservative ingredient.

5 In preparation of a wood preservative composition containing copper borate and zinc borate as preservative ingredients, firstly, copper borate, zinc borate and a small quantity of water are mixed at room temperature to prepare a paste or slurry. Secondly, an appropriate quantity of aqueous ammonia or other volatile basic compound is added to the paste or slurry, and stirred to prepare a solution. Finally, a necessary quantity of water is added to the solution to prepare wood preservative composition containing copper borate and zinc borate as preservative ingredients. Also, if required, in the first step, appropriate quantities of other copper compound, zinc compound, and additives are added.

10 As another preparation, a first water solution which contains copper borate, and a second water solution which contains zinc borate are separately prepared. Thereafter, the first water solution and the second water solution are mixed to prepare a wood preservative composition containing copper borate and zinc borate as preservative ingredients.

15 The above-prepared solution is impregnated into wood in the following way. A closed chamber is filled with the preservative impregnating solution. Wood is placed in the chamber. The pressure in the chamber is reduced to a pressure of 600-700 mm Hg so that air in the wood is evacuated. Thereafter, the pressure in the chamber is restored to a normal pressure so that the wood preservative solution is impregnated into the wood.

20 Also, the wood preservative solution may be impregnated into wood at a high pressure of 5-20 kg/cm², or at usual temperature and pressure, by means of known impregnating equipment.

The above-impregnated wood is naturally dried by placing it in the air for several days, or forcibly dried by heating it at a temperature of 50-60°C so as to remove the volatile basic compound and water from the impregnated wood. Consequently wood fixed with wood preservative is obtained.

25 The following examples and test examples shows the present invention in greater detail.

EXAMPLE 1

Copper tetraborate, monobasic	1.140 parts
30 and Ammonium chloride	0.30 parts

were entirely mixed in the form of powder.

Aqueous ammonia (25 percent)	3.80 parts
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40 were added to the mixture, and stirred to partially dissolve the compounds.

Water	24.76 parts
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45 were added to the composition, and stirred to completely dissolve the compounds.

Water	70.00 parts
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50 were further added and stirred.

55 Consequently, a preservative composition or impregnating solution was obtained which is homogeneous and blue in color.

EXAMPLE 2

composition	Copper tetraborate, monobasic	0.770 parts
5	Trimethylamine solution (30 percent)	10.09 parts
	Ammonium chloride	2.02 parts
10	and Water	87.12 parts

were mixed under stirring in steps similar to EXAMPLE 1. Consequently, a preservative composition was obtained.

15 EXAMPLE 3

A first solution

20	Copper tetraborate, monobasic	0.380 parts
	Aqueous ammonia (25 percent)	1.26 parts
25	Ammonium chloride	0.10 parts
	and Water	92.06 parts

30 were mixed under stirring in steps similar to EXAMPLE 1. Consequently, the first solution was obtained which is homogeneous and blue in color.

A second solution

35	Zinc chloride	10.4 parts
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were dissolved in

40	Water	31.6 parts
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45 to produce a semitransparent solution.

	Aqueous ammonia (25 percent)	21.0 parts
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50 were immediately added to the solution, and stirred until a transparent solution was obtained.

	Water	37.0 parts
--	-------	------------

55 were further added and stirred. Consequently,

A transparent solution

100.0 parts

5 were obtained through a state of semitransparent solution. This transparent solution is the second solution.

The first solution

93.8 parts

10 and the second solution

6.2 parts

15 were mixed under stirring. Consequently, a preservative composition was obtained which is homogeneous and blue in color.

16 EXAMPLE 4

20 Copper tetraborate, monobasic

0.380 parts

25 Aqueous ammonia (25 percent)

2.92 parts

and Water

96.70 parts

30 were mixed under stirring in steps similar to EXAMPLE 1. Consequently, a preservative composition was obtained which is homogeneous and blue in color. This example required slightly longer time to obtain the homogeneous blue solution than EXAMPLE 1.

31 EXAMPLE 5

35 Copper tetraborate, dibasic

0.334 parts

40 Ammonium bicarbonate

0.62 parts

45 Aqueous ammonia (25 percent)

0.58 parts

50 and Water

98.466 parts

55 were mixed under stirring in steps similar to EXAMPLE 1. Consequently, a preservative composition was obtained.

60 EXAMPLE 6

65 Copper tetraborate, tribasic

0.310 parts

70 Aqueous ammonia (25 percent)

0.54 parts

75 Ammonium bicarbonate

0.55 parts

80 and Water

98.60 parts

were mixed under stirring in steps similar to EXAMPLE 1. Consequently, a preservative composition was obtained.

EXAMPLE 7

5

Zinc tetraborate, dibasic	1.315 parts
and Ammonium chloride	2.05 parts

were entirely mixed in the form of powder.

Aqueous ammonia (25 percent)	6.13 parts
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were added to the mixture, and kneaded to obtain a homogeneous composition.

20

Water	20.00 parts
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were added to the composition, and stirred to completely dissolve the compounds.

25

Water	70.505 parts
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30 were further added and stirred, so that a preservative composition was obtained which has an appropriate concentration.

EXAMPLE 8

35 Tetra zinchydroxide,tri(tetraboric acid) salt

(in the trademark of ZINC BORATE 2335) 1.023 parts

40 Aqueous ammonia (25 percent)	3.07 parts
Ammonium chloride	1.02 parts
45 and Water	94.887 parts

were mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

EXAMPLE 9

50

Tetra zinchydroxide,tri(tetraboric acid) salt

55

5	(in the trademark of ZINC BORATE 2335) 1.023 parts	5
10	Triethylamine solution (30 percent) 15.21 parts	10
15	Ammonium chloride 2.41 parts	15
20	and Water 81.357 parts	20

were mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

EXAMPLE 10

20	Tetra zinhydroxide,tri(tetraboric acid) salt	20
25	(in the trademark of ZINC BORATE 2335) 1.030 parts	25
30	Pentahydrated copper sulphate 0.605 parts	30
35	Ammonium chloride 1.03 parts	35
40	Aqueous ammonia (25 percent) 4.09 parts	40
45	and Water 93.245 parts	45

were mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

EXAMPLE 11

35	Tetra zinhydroxide,tri(tetraboric acid) salt	35
40	(in the trademark of ZINC BORATE 2335) 1.030 parts	40
45	Aqueous ammonia (25 percent) 0.75 parts	45
50	and Water 98.22 parts	50

were stirred at room temperature for 27 hours, and mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

Also, when 1.00 part of water was replaced with ammonium chloride, another preservative composition was obtained by stirring the solution for 2 hours. Accordingly, it will be seen that ammonium compound such as ammonium chloride is effective to increase the dissolving rate.

EXAMPLE 12

Zinc hydroxide.dimetaboric acid salt

(in the trademark of ZINC BORATE 101) 0.890 parts

5 Aqueous ammonia (25 percent) 4.88 parts

Ammonium chloride 0.09 parts

and Water 94.14 parts

10 were mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

EXAMPLE 13

15 Copper tetraborate, monobasic 0.383 parts

Zinc tetraborate, dibasic salt 0.659 parts

20 Aqueous ammonia (25 percent) 5.98 parts

Ammonium chloride 1.11 parts

25 and Water 91.868 parts

were mixed in steps similar to EXAMPLE 7. Consequently, a preservative composition was obtained.

30 EXAMPLE 14

A first solution

35 Copper tetraborate monobasic 0.192 parts

Aqueous ammonia (25 percent) 1.46 parts

40 Ammonium chloride 0.04 parts

and Water 48.308 parts

45 consequently, a
live composition
ium compound
were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is
homogeneous and blue in color.

A second solution

50 Tetra zinchydroxide, tri(tetraboric acid) salt

55

(in the trademark of ZINC BORATE 2335) 0.512 parts
 5 Aqueous ammonia (25 percent) 1.53 parts
 Ammonium chloride 0.51 parts
 10 and Water 47.448 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is
 colorless homogeneous

15 Thereafter, the first solution and the second solution were mixed, so that a preservative composition
 was obtained.

EXAMPLE 15

A first solution

20 Copper tetraborate monobasic 0.383 parts
 Aqueous ammonia (25 percent) 2.91 parts
 25 Ammonium chloride 0.08 parts
 and Water 46.627 parts

30 were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is
 homogeneous and blue in color.

A second solution

Tetra zinchydroxide tri(tetraboric acid) salt

35 (in the trademark of ZINC BORATE 2335) 1.535 parts
 40 Aqueous ammonia (25 percent) 4.61 parts
 Ammonium chloride 1.54 parts
 45 and Water 42.315 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is
 colorless homogeneous.

50 Thereafter, the first solution and the second solution were mixed, so that a preservative composition
 was obtained.

EXAMPLE 16

55 A first solution

5	Copper tetraborate monobasic	0.767 parts
	Aqueous ammonia (25 percent)	5.82 parts
	Ammonium chloride	0.16 parts

10 and Water 43.253 parts

15 were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

A second solution

20 Tetra zinchydroxide,tri(tetraboric acid) salt

25	(in the trademark of ZINC BORATE 2335)	2.043 parts
	Aqueous ammonia (25 percent)	6.13 parts
	Ammonium chloride	2.04 parts
30	and Water	39.787 parts

which is
25 were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is colorless homogeneous.

Thereafter, the first solution and the second solution were mixed, so that a preservative composition
30 was obtained.

EXAMPLE 17

40 A first solution

45	Copper tetraborate monobasic	0.383 parts
	Aqueous ammonia (25 percent)	2.91 parts
	and Water	46.707 parts

50 were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

A second solution

55 Tetra zinchydroxide,tri(tetraboric acid) salt

(in the trademark of ZINC BORATE 2335) 1.030 parts
Aqueous ammonia (25 percent) 3.09 parts
and Water 45.88 parts

were mixed in stops similar to EXAMPLE 7. Consequently, the second solution was prepared which is
colorless homogeneous.

Thereafter, the first solution and the second solution were mixed, so that a preservative composition was obtained.

EXAMPLE 18

A first solution

	Copper tetraborate monobasic	0.192 parts
20	Aqueous ammonia (25 percent)	0.64 parts
	Ammonium chloride	0.05 parts
25	and Water	49.118 parts

were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

A second solution

Zinc hydroxide, dimetaboric acid salt

35	(in the trademark of ZINC BORATE 101)	0.440	parts
	Aqueous ammonia (25 percent)	2.41	parts
40	Ammonium chloride	0.04	parts
	and Water	47.11	parts

75 were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is colorless homogeneous.

Thereafter, the first solution and the second solution were mixed, so that a preservative composition was obtained.

50 EXAMPLE 19

A first solution

5	Copper tetraborate monobasic	0.383 parts
10	Aqueous ammonia (25 percent)	1.28 parts
15	Ammonium chloride	0.10 parts
20	and Water	48.237 parts

were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

25 15 A second solution

30 Zinc hydroxide.dimetaboric acid salt

20	(in the trademark of ZINC BORATE 101)	0.890 parts
25	Aqueous ammonia (25 percent)	4.88 parts
30	Ammonium chloride	0.09 parts
35	and Water	44.14 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is colorless homogeneous.

35 Thereafter, the first solution and the second solution were mixed, so that a preservative composition was obtained.

40 EXAMPLE 20

45 35 A first solution

40	Copper tetraborate dibasic	0.167 parts
45	Aqueous ammonia (25 percent)	0.29 parts
50	Ammonium bicarbonate	0.31 parts
55	and Water	49.233 parts

were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

50 A second solution

55 Tetra zinchydroxide.tri(tetraboric acid) salt

(in the trademark of ZINC BORATE 2335) 0.511 parts

Aqueous ammonia (25 percent)	0.99 parts
Ammonium chloride	0.17 parts
Ethylenediamine	0.03 parts
and Water	48.299 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is
colorless homogeneous.

Thereafter, the first solution and the second solution were mixed, so that a preservative composition
was obtained

EXAMPLE 21

A first solution

Copper tetraborate dibasic	0.167 parts
Aqueous ammonia (25 percent)	0.29 parts
Ammonium bicarbonate	0.31 parts
and Water	49.233 parts

were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is
homogeneous and blue in color.

A second solution

Tetra zinchydroxide, trif(tetraboric acid) salt	
(in the trademark of ZINC BORATE 2335) 1.023 parts	
Aqueous ammonia (25 percent)	1.98 parts
Ammonium chloride	0.34 parts
Ethylenediamine	0.07 parts
and Water	46.587 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is
colorless homogeneous.

Thereafter, the first solution and the second solution were mixed, so that a preservative composition
was obtained.

EXAMPLE 22

A first solution

5	Copper tetraborate tribasic	0.154 parts
10	Aqueous ammonia (25 percent)	0.27 parts
15	Ammonium bicarbonate	0.28 parts
20	and Water	49.296 parts

which is
composition
were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

A second solution

25	Tetra zinchydroxide,tri(tetraboric acid) salt	
30	(in the trademark of ZINC BORATE 2335)	0.510 parts
35	Aqueous ammonia (25 percent)	0.99 parts
40	Ammonium chloride	0.17 parts
45	Ethylenediamine	0.03 parts
50	and Water	48.30 parts

which is
composition
were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is colorless homogeneous.

40 Thereafter, the first solution and the second solution were mixed, so that a preservative composition was obtained.

EXAMPLE 23

45 A first solution

50	Copper tetraborate tribasic	0.077 parts
55	Aqueous ammonia (25 percent)	0.19 parts
60	Ammonium bicarbonate	0.14 parts
65	and Water	49.593 parts

which is
composition
were mixed in steps similar to EXAMPLE 1. Consequently, the first solution was prepared which is homogeneous and blue in color.

A second solution

Tetra zinchydroxido,tri(tetraboric acid) salt

5	(in the trademark of ZINC BORATE 2335) 0.770 parts	
10	Aqueous ammonia (25 percent)	1.49 parts
15	Ammonium chloride	0.26 parts
20	Ethylenediamine	0.05 parts
25	and Water	47.43 parts

were mixed in steps similar to EXAMPLE 7. Consequently, the second solution was prepared which is colorless homogeneous.

20 Thereafter, the first solution and the second solution were mixed, so that a preservative composition was obtained.

Wood was treated with the wood preservative compositions obtained in EXAMPLEs 1 to 23 as follows.

25 The obtained wood preservative composition was filled in a water-tight closed chamber. A sapwood piece of Japanese red pine of 1 x 2 x 5 cm in size was placed in the wood preservative composition. The pressure in the chamber was reduced to 700 mm Hg. The sapwood piece was impregnated with the wood preservative composition by holding it in the wood preservative composition for 10 - 20 minutes.

30 The impregnated sapwood piece was dried by placing it in the air at room temperature for 1 - 2 days, and then dried by heating it at a temperature of 60°C for 48 hours so as to completely remove the volatile basic compound and water. Consequently, wood fixed with the wood preservative was obtained.

35 The amount of wood preservative composition with respect to the sapwood piece, the respective absorption amounts of copper borate, zinc borate, copper, zinc, and boric acid equivalent to boron of the active ingredient, and the respective leaching rates of copper, zinc, boric acid equivalent to boron of the active ingredient are shown in TABLEs 1-1, 1-2. It could be seen in TABLEs 1-1, 1-2 which show each of the wood preservative compositions of EXAMPLEs 1 - 23 provided quite good fixing of wood preservatives.

40 It should be noted that in TABLE 1-1, Z/B denotes zinc borate, C/B denotes copper borate, Fixed B denotes fixed boric acid, and Free B denotes free boric acid. Also, it should be noted that in EXAMPLE 3, zinc chloride was absorbed in place of zinc borate, and in EXAMPLE 10, copper sulphate was absorbed in place of copper borate.

45 The leaching rate of wood preservative compositions of EXAMPLEs 1 - 23 is calculated as follows. Three treated wood pieces were placed in a 500ml beaker, and 400ml pure water were poured into the beaker and stirred at room temperature for 48 hours to leach preservative ingredients. The amount of each leached-out preservative ingredient was measured, and the leaching rate (LR) of the preservative ingredient was calculated in accordance with the following equation:

$$45 \quad LR = A : B \times 100$$

wherein A denotes the amount of preservative ingredient leached out in the pure water, and B denotes the amount of preservative ingredient absorbed in the wood piece.

50 The anti-fungi effectivenesses of wood preservative compositions of EXAMPLEs 1 - 23 were tested. The test was made based on JIS A9302, "TESTING METHODE OF ANTI-FUNGI EFFECTIVENESS OF WOOD PRESERVATIVE COMPOSITION". Specifically, sterilized sea sand is placed in a wide-mouthed bottle. A culture solution including glucose peptone and an extract of malt are poured into the bottle. The following fungi are used for the test:

55 *Coriolus Palustris* (BERK. et CORT) MURR Linshi 0507;
Coriolus Versicolor (Lex FR) QUEL Linshi 1030.

The fungi were cultured in the bottle at a temperature of 26°C under 70% RH for 10 - 15 days. A sapwood of Japanese cedar of 2 x 2 x 1 cm in size so treated is placed in the bottle as a test piece and left at a temperature of 26°C under 70% RH for 90 days. The weights of the test piece before and after the test

are measured. The averaged weight reduction rates and anti-fungi effectivenesses were calculated from the obtained measurements. TABLES 2-1, 2-2 show results of the wood preservative compositions of EXAMPLES 1 - 23 in accordance with the above-mentioned test method.

The anti-fungi effectiveness (AFE) was calculated on the basis of the following equation:

5

$$AFE = (B - A) / B \times 100$$

wherein B denotes the averaged weight reduction rate of a not-treated wood piece, and A denotes the averaged weight reduction rate of a treated wood piece.

10 TABLES 2-1, 2-2 show results of weatherability tests for the wood preservative compositions of EXAMPLES 1 - 23. The weatherability test was carried out as follows. One wood piece treated with one of the wood preservatives of EXAMPLES 1 - 23 and another wood piece treated with the same preservative were prepared. The one wood piece was subjected to weathering ten times. The another wood piece was not subject to the weathering. The weathering was carried out by washing a test piece with a predetermined 15 amount of water, and drying the washed test piece for a predetermined time.

15 The anti insect effectivenesses of the wood preservative compositions of EXAMPLES 1 - 23 were determined based on tests in accordance with "GENERAL TESTS OF TESTING METHOD OF APPLYING, SPRAYING, AND IMPREGNATING WOOD PRESERVATIVES (1), LABORATORY TEST METHODS" specified in Regulation No. 11, 1981 of Japan Wood-Preservers' Association Standard, No. 12, 1981.

20 Specifically, a given amount of plaster was poured and solidified in a container having 8 cm in diameter and 6 cm in height. A sapwood of Japanese red pine of 2 x 1 x 1 cm in size so treated was placed on the solidified plaster. 150 workers and 15 soliders of coptotermes formosanus SHIRAKI were released in the container. Subsequently, the container was covered with a lid having air holes and wet cotton padding on the underside thereof, and held in a dark room at a temperature of 28°C for 21 days. Thereafter, the 25 number of died bodies was counted, and the weight of the wood piece before and after the test were measured. TABLES 3-1, 3-2 show results of this test. It should be noted that in TABLES 3-1, 3-2, the upper row of each example shows data concerning the test piece not subjected to the weathering, and the lower row shows data concerning the test piece subjected to the weathering. Also, weatherability tests were carried out in the same way as those in the anti-fungi effectiveness test.

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TABLE I-1 (Absorbed Amount)

Example No.	Impregnating Amount (Kg/m ³)	Absorbed Amount (Kg/m ³)					
		C/B	Z/B	Cu	Zn	Fixed B	Free B
1	660	7.50	--	3.00	--	5.90	--
2	650	5.00	--	2.00	--	3.90	--
3	650	2.49	4.10	1.00	2.00	1.95	--
4	650	2.49	--	1.00	--	1.95	--
5	650	2.17	--	1.00	--	0.97	0.32
6	656	2.01	--	1.01	--	0.78	0.19
7	665	--	8.74	--	4.09	2.58	2.58
8	639	--	6.54	--	1.97	3.72	1.86
9	650	--	6.65	--	2.00	3.78	1.89
10	645	3.90	6.64	0.99	2.00	3.78	1.89
11	640	--	6.59	--	1.98	3.75	1.89
12	651	--	5.79	--	2.00	1.91	1.91
13	670	2.57	4.41	1.03	2.06	2.01	1.30
14	643	1.24	3.29	0.50	0.99	2.85	0.93
15	625	2.40	9.60	0.96	2.89	7.32	2.73
16	653	5.00	13.36	2.01	4.02	11.52	3.80
17	650	2.49	6.64	1.00	2.00	5.76	0.94
18	640	1.23	2.82	0.49	0.99	1.89	0.93
19	650	2.49	5.74	1.00	2.01	3.86	1.91
20	650	1.09	3.32	0.50	1.01	2.38	1.11
21	660	1.10	6.75	0.51	2.03	4.34	3.09
22	652	1.01	3.32	0.50	0.99	2.27	1.04
23	649	0.50	4.98	0.25	1.51	3.03	1.47

5 10 15 20 25 30 35 40 45 50 55

TABLE 1-2 (Leaching Rate)

Example No.	Leaching Rate (%)		
	Cu.	Zn	Boric Acid
1	8.00	--	19.00
2	9.00	--	25.00
3	6.40	8.90	43.70
4	9.00	--	25.00
5	6.50	--	18.30
6	2.60	--	16.20
7	--	6.00	7.50
8	--	9.40	19.70
9	--	10.10	18.50
10	9.10	9.40	19.70
11	--	9.20	19.80
12	--	9.00	15.30
13	4.00	8.80	10.50
14	8.57	16.43	11.60
15	6.67	6.81	3.02
16	3.31	5.38	0.00
17	3.42	7.57	0.00
18	7.50	8.30	9.50
19	5.30	7.10	6.40
20	8.50	4.60	7.70
21	7.30	2.70	6.30
22	10.40	9.30	0.00
23	16.30	10.20	0.00

TABLE 2-1
(*Corticolellus Palustris*)

Example No.	Averaged Reduction		Effectiveness of Anti-Fungi (%)	
	Rate of Weight (%)		No-Weather.	10-Weather.
	No-Weather.	10-Weather.		
1	0.5	1.8	99	95
2	0.5	2.0	99	95
3	0.9	1.9	97	96
4	0.5	2.4	97	94
5	0.5	2.0	99	95
6	0.5	2.1	99	94
7	1.1	2.2	97	94
8	0.0	1.9	100	95
9	0.0	1.5	100	96
10	0.0	0.8	100	98
11	0.0	1.9	100	95
12	1.0	2.5	97	93
13	0.0	1.1	100	97
14	0.4	1.9	99	95
15	0.0	0.3	100	99
16	0.0	0.0	100	100
17	0.0	0.8	100	98
18	0.2	0.7	99	98
19	0.0	1.0	100	97
20	0.2	0.8	99	98
21	0.0	0.6	100	98
22	0.2	0.8	99	98
23	0.3	0.7	99	98
Not- treated	37.3			

TABLE 2-2
(*Curtulius Versicolor*)

Example No.	Averaged Reduction		Effectiveness of Anti-Fungi (%)	
	Rate of Weight (%)		No-Weather:	10-Weather:
	No-Weather.	10-Weather.		
1	0.4	1.0	98	96
2	0.9	1.8	96	92
3	0.8	1.6	97	94
4	1.2	2.5	95	89
5	1.0	2.5	96	89
6	1.1	2.7	95	89
7	1.2	1.9	95	92
8	0.5	1.4	98	94
9	0.5	1.7	98	93
10	0.5	1.4	98	94
11	0.5	2.0	98	91
12	1.3	2.3	94	90
13	0.5	1.4	98	94
14	0.9	1.4	96	94
15	0.5	1.3	98	94
16	0.5	1.2	98	95
17	0.5	1.3	98	94
18	0.7	1.5	97	94
19	0.3	1.5	99	95
20	0.7	1.5	97	94
21	0.5	1.1	98	95
22	0.8	1.3	97	94
23	1.0	2.2	96	91
Not- treated	23.5			

TABLE 3-1

Example No.	Death Rate (%)		Reduction Rate of Weight (%)	
	Min. - Max.	Average	Min. - Max.	Average
1	100 - 100	100	0.13 - 0.75	0.40
	98 - 100	99	0.21 - 0.96	0.61
2	100 - 100	100	0.20 - 0.80	0.52
	95 - 100	98	0.32 - 1.00	0.65
3	100 - 100	100	0.21 - 0.78	0.50
	95 - 100	97	0.35 - 0.99	0.60
4	100 - 100	100	0.15 - 0.75	0.50
	97 - 100	97	0.30 - 0.90	0.60
5	100 - 100	100	0.20 - 0.75	0.50
	95 - 100	98	0.30 - 0.90	0.60
6	100 - 100	100	0.30 - 1.10	0.70
	93 - 100	97	0.40 - 1.50	1.00
7	100 - 100	100	0.00 - 0.20	0.10
	97 - 99	98	0.20 - 0.50	0.40
8	100 - 100	100	0.00 - 0.20	0.10
	100 - 100	100	0.00 - 0.30	0.20
9	100 - 100	100	0.00 - 0.15	0.10
	100 - 100	100	0.00 - 0.15	0.10
10	100 - 100	100	0.00 - 0.15	0.10
	100 - 100	100	0.00 - 0.15	0.10
11	100 - 100	100	0.00 - 0.20	0.10
	97 - 100	99	0.20 - 0.75	0.48
12	100 - 100	100	0.20 - 0.80	0.52
	95 - 100	98	0.30 - 1.00	0.65

TABLE 3-2

Example No.	Death Rate (%)		Reduction Rate of Weight (%)	
	Min. - Max.	Average	Min. - Max.	Average
13	100 - 100	100	0.00 - 0.20	0.10
	98 - 100	99	0.00 - 0.30	0.21
14	100 - 100	100	0.20 - 0.75	0.50
	95 - 100	98	0.30 - 0.90	0.60
15	100 - 100	100	0.00 - 0.20	0.10
	97 - 99	98	0.20 - 0.50	0.40
16	100 - 100	100	0.00 - 0.00	0.00
	100 - 100	100	0.00 - 0.00	0.00
17	100 - 100	100	0.25 - 0.75	0.50
	96 - 100	98	0.40 - 0.90	0.65
18	100 - 100	100	0.20 - 0.80	0.50
	94 - 100	97	0.40 - 0.90	0.65
19	100 - 100	100	0.25 - 0.75	0.50
	95 - 100	97	0.45 - 0.97	0.71
20	100 - 100	100	0.20 - 0.75	0.50
	95 - 100	98	0.30 - 0.90	0.60
21	100 - 100	100	0.20 - 0.70	0.45
	95 - 100	98	0.40 - 0.80	0.60
22	100 - 100	100	0.20 - 0.75	0.50
	95 - 100	98	0.30 - 0.90	0.60
23	100 - 100	100	0.10 - 0.50	0.30
	96 - 100	98	0.20 - 0.75	0.50

Claims

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1. A wood preservative composition comprising:

a preservative component which is selected from the group consisting of copper borate and zinc borate;

a volatile basic compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group; and
water.

5 2. A wood preservative composition according to Claim 1 wherein the preservative component includes a
copper borate and a zinc borate.

10 3. A wood preservative composition according to Claim 1 wherein the preservative component includes a
copper borate and a zinc compound.

15 4. A wood preservative composition according to Claim 1 wherein the preservative component includes a
zinc borate and a copper compound.

15 5. A wood preservative composition according to Claim 1 wherein the copper borate is copper tetraborate
monobasic.

20 6. A wood preservative composition according to Claim 1 wherein the copper borate is copper tetraborate
dibasic.

20 7. A wood preservative composition according to Claim 1 wherein the copper borate is copper tetraborate
tribasic.

25 8. A wood preservative composition according to Claim 1 wherein the zinc borate is zinc tetraborate
dibasic.

25 9. A wood preservative composition according to Claim 1 wherein the zinc borate is zinc tetrahydroxide
tri(tetraboric acid) salt.

30 10. A wood preservative composition according to Claim 1 wherein the zinc hydroxide dimetaboric acid
salt.

30 11. A wood preservative composition according to Claim 1 wherein the volatile basic compound is amine.

35 12. A wood preservative composition according to Claim 1 wherein the volatile basic compound is
ammonia.

35 13. A wood preservative composition according to Claim 1 comprising 0.1 - 10 parts by weight of the
preservative component with respect to 100 parts by weight of the wood preservative composition.

40 14. A wood preservative composition according to Claim 1 comprising 0.5 - 2 parts by weight of the
preservative component with respect to 100 parts by weight of the wood preservative composition.

40 15. A wood preservative composition according to Claim 1 comprising 75 - 160 parts by weight of the
volatile basic compound with respect to 100 parts by weight of the preservative component.

45 16. A wood preservative composition according to Claim 1 comprising 75 - 100 parts by weight of the
volatile basic compound with respect to 100 parts by weight of the preservative component.

45 17. A process for preserving wood comprising the steps of:
50 impregnating the wood with a wood preservative composition including a preservative component
which is selected from the group consisting of copper borate and zinc borate, a volatile basic
compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water;
and
drying the impregnated wood to remove the volatile basic compound and water.

55 18. A process according to Claim 17 wherein the impregnating step including :
flowing a predetermined amount of the wood preservative composition into a closed chamber;
placing the wood in the preservative composition in the chamber;

lower alkyl
reducing the pressure in the chamber to remove air from the wood; and
increasing the pressure in the chamber so as to inject the preservative composition into the wood.

19. A wood preserved by:

5 impregnating the wood with a wood preservative composition including a preservative component
which is selected from the group consisting of copper borate and zinc borate, a volatile basic
compound of the formula R_3N , wherein R is one of hydrogen atom and lower alkyl group, and water;
and

10 drying the impregnated wood to remove the volatile basic compound and water.

10 20. A wood according to Claim 19 containing 0.5 or more kilograms of the preservative component with
respect to 1 cubic meter of the wood.

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tetaborate

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tetaborate

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